Fermilab

Particle Physics Division
Mechanical Department Engineering Note

Number: MD-ENG- 268 Date: August 12, 2010

Project Internal Reference:

Project: M-Test

Title: Test Beam Turntable

Author(s): Edward Chi

Reviewer(s):

Key Words: Turntable, Rotation, Index, Drive, weight, Speed, RPM, Voltage, Encoder, Remote, Capacity, Diameter, Deck.

Abstract Summary:

M-Test is looking for a Test Beam Turntable which has certain application requirements, there are several different commercial equipments which can be used as part of the Beam Test Turntable are available in the market. The product specification, vendor information, cost, lead time and other factors are presented for discussion and comparison.

Applicable Codes:

The Given Criteria of the Test Beam Table:

- Load capacity: ~ 2,000 lbs.
- 1 meter diameter or other shape for the loading table.
- Rotate with one (1) degree accuracy.
- Remote control.

Some pending information will be very helpful for further detail design:

1. The configuration of the object will be on the turntable, how is the load to be distributed? (Reasonable approximate conservative assumption will be fine).

2. Speed of the turntable (rpm), speed range, any acceleration or deceleration rate requirement?

3. The manner of stop and positioning: Let the friction and inertia take care themselves or it requires the brake or some positioning device?

4. Any information which will be one of the transmission system's accelerated torque factor will be very help for the further Design (or purchase) details.

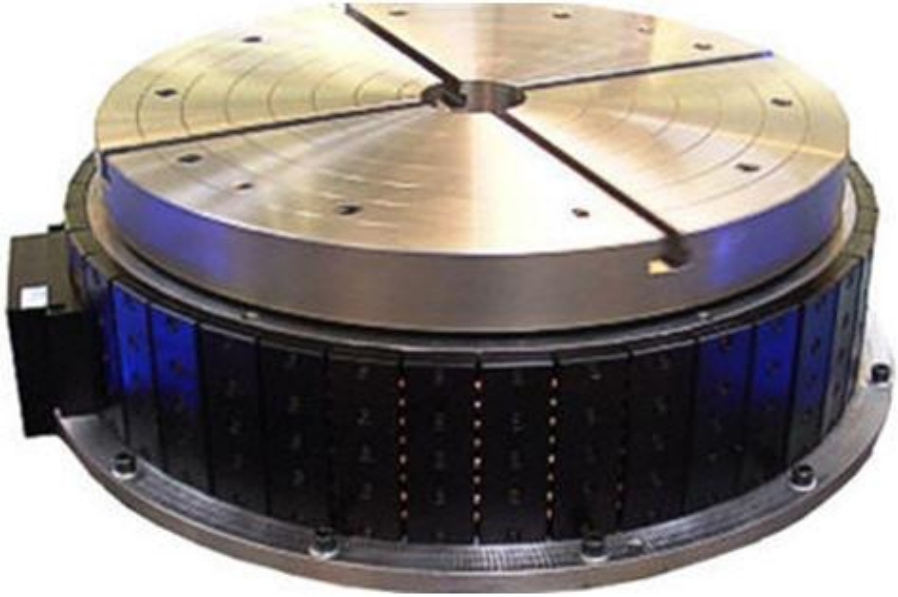
5. Will the equipment be in the radiation area? If it is, what is the radiation level is?

6. Electrical power: 240v or 120V? Three phase AC motor is ok? Or What's your choice?

ServoRing HL rotary table

From: IntelLiDrives, Inc.

http://www.intellidrives.com/



Major features:

- Director Drive Torque Motors (no gear transmission).
- Large diameter working table, 1 meter is ok.
- Load capacity can be up to more than 2,000 lbs.
- Since using the Servo motor with built in high accuracy encoder and bearings, the repeatability is very high, motion is very smooth.
- The system is ready to connect to the Amplifiers and Controllers for the remote operation.
- The overall mass weight is ~300 kg (~660 lbs.)

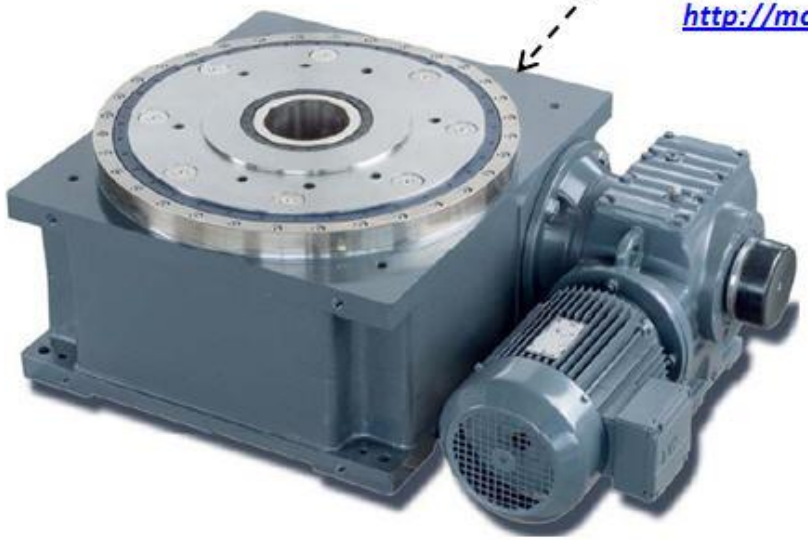
Some Concerns:

- It is pricy: **~$50,000** per each standard unit.
- There is no stock item, every unit will start to manufacture after the ordering, delivery time will be more than 20 weeks.
- Fermilab still needs to build the sub-structure (device) to retrofit our application.
- Does our application need such high degree of accuracy?
- The Vendor's reputation needs further detail study.

Rotary Index Drive (RT400)

Motion Index Drives, Inc.

http://motionindex.wordpress.com/



Specifications, Price & Lead time (RT400):

- Output flange diameter: 18.11"
- Overall Height: 12.44"
- Base house dim: 24.4" x 24.4"
- Build in AC motor with the gear reducer(s)
- Encoder & motor brake (option)
- load capacity up to 10,000 lbs.
- Lab's choice for the table speed range (rpm).
- The repeatability is within +/- 0.01 deg.
- Overall weight ~ 715 lbs.
- ~ 8 weeks deliver time after ordering.
- Ready to connect the controller for remote.
- ~***$20,000 per unit*** (RT400)

$D_o = 29.52"$
$D_i = 17.32"$

TSR 600
~$ 20,000/unit

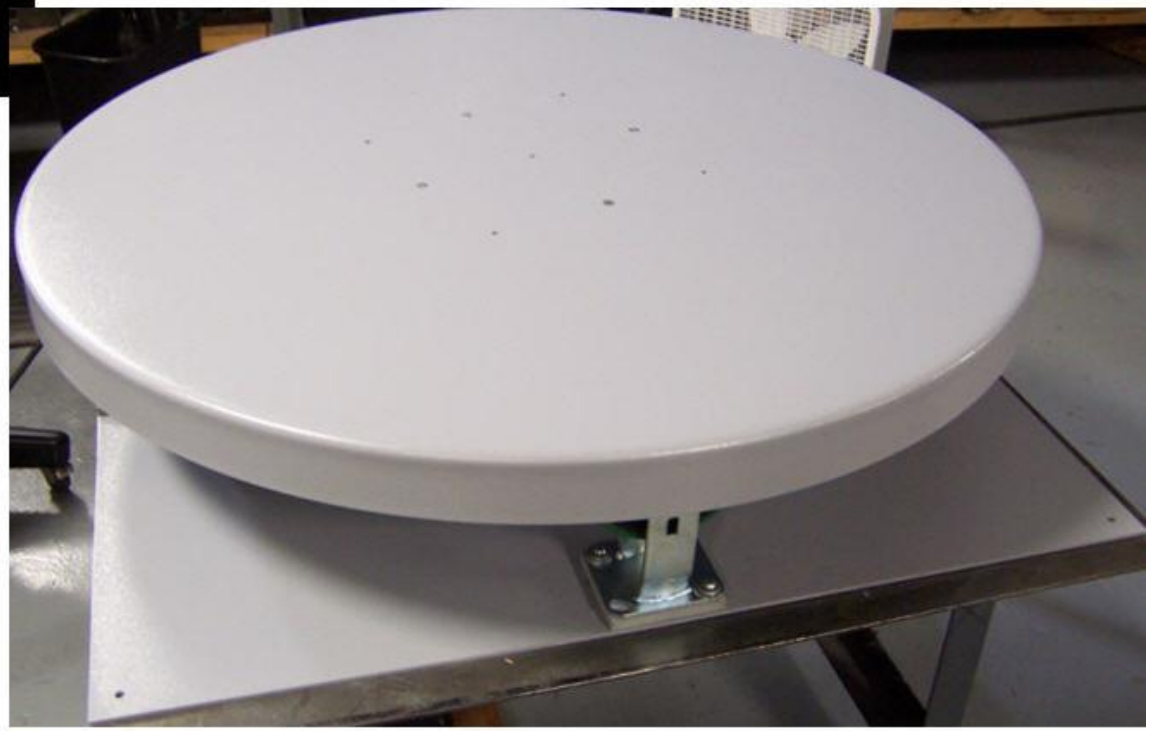
Specifications, Price & Lead time (RT315):

- Output flange diameter: 14.16"
- Overall Height: 9.59"
- Base house dim: 18.5" x 18.5"
- Build in AC motor with the gear reducer(s)
- Encoder & motor brake (option)
- load capacity up to 6,000 lbs.
- Lab's choice for the table speed range (rpm).
- The repeatability is within +/- 0.01 deg.
- Overall weight ~ 600 lbs.
- ~ 8 weeks deliver time after ordering.
- Ready to connect to the controller for remote.
- ~***$12,000 per unit*** (RT315)

Heavy Duty Turntable from Vue-More (http://www.vuemore.com/heavy-duty.html)

Specifications:

- 2,000 lbs capacity
- Motorized rotation, constant speed, N = 1 rpm
- Top loading table size: 43.0" diameter (with t = 0.16" formed steel plate)
- Base plate size: 40" x 40" x 0.21" steel plate.
- Overall height: 9.25"
- Weight: 275 lbs (per vendor's estimate).
- 110 volts with plug in connection.



Some issues:

- There is no lifting/handling device for moving the whole unit, no lock position device either.
- No adjustment for the height.
- 240 volt, 3 phase motor can be as option but have to pay the extra.
- The rpm (speed) of the table can be variable, but have to pay extra.
- The vendor has not disclosed that which industrial code applied for design and manufacture.

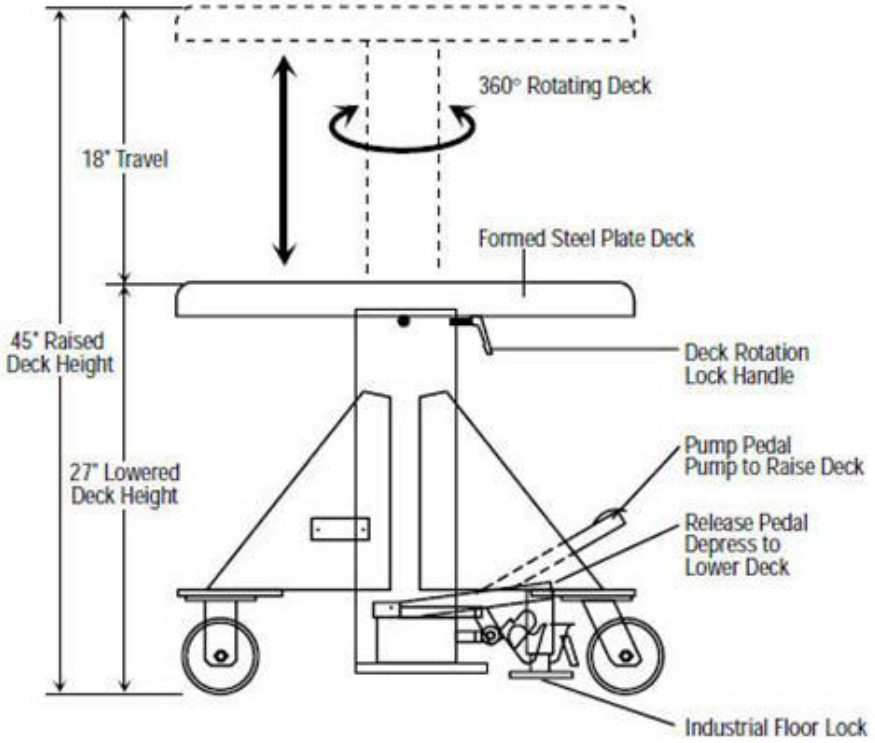
Price:

$3,300 per each standard unit, no stock item, deliver will be 3 – 4 weeks after ordering.

Lange Lift Die Table
2,000 lbs. capacity
(1,000# to 4,000# capacity)
With square deck
30" x 30" or
(24"x 24", 36" x 36", 48" x 48")
$1,753.0 /standard table

Main Features:

- 360 deg. Rotation, lock deck (table) in any position at any height.
- Easily move the table to any location and secured it with the industrial floor lock.
- Hydraulic foot pump raises or lowers the working deck to the desired height.
- Reinforced steel deck – ¼" thick formed steel plate



Some Options:

- Round or rectangular deck.
- Floor mountable (fixed).
- Power up and down with electrical or pneumatic.
- Power rotation (with gear device for index positioning)
- Tilt deck in certain angles (0 to 90 degree).
- Telescopic cylinder lift.
- Roller conveyor or ball transfer tops (see next page)
- Other customer's options

More options for the Lange Lift Die Table
http://www.langelift.com/

Die Table With Round Top

Die Table With 45° Tilt Top

Die Table With Ball Transfer Top

Die Table With Conveyor Top

Die Table With Tow Handle

Die Table With Tilt Top

Reference:

(Related emails with the project)

-----Original Message-----
From: Edward Chi [mailto:edchi@fnal.gov]
Sent: Friday, August 06, 2010 3:15 PM
To: 'Dave Pushka'; 'Aria Meyhoefer'
Subject: RE: FW: Test Beam Turntable

Hi Dave and Aria,

So far, it was not too successful for searching the commercial equipment to use as the Test Beam Turntable. As you know, there are several Criteria we have to follow:

1. Load capacity: ~ 2,000 lbs.
2. 1 meter diameter or other shape for the loading table.
3. Rotate with 1 degree accuracy (what kind of speed-rpm?).
4. Remote (wire or wireless?)

However, I still come out some commercial turntables which do not exactly meet our requirements but will carry partial task. The attached slides are showing some commercial equip. for the test beam turntable, the price range will be from ~$50,000 to $1,753 based on the product specification.
So far, I believe that the "Rotary Index Drive" should be good for our applications, but it still needs some sub-structures and accessories to make it as an applicable turntable, especially, it requires the controller with the amplifiers for remote application.

In order to optimize the transmission system to minimize the cost, it will be nice to know:

1. The configuration of the object to be on the turntable, how is the load to be distributed? (Reasonable approximate conservative assumption will be fine).
2. Speed of the turntable (rpm), speed range, any acceleration or deceleration rate requirement?
3. The manner of stop and positioning: Let the friction and inertia taking care themselves or it requires the brake or some positioning device?
4. Any information which will be one of the transmission system's accelerated torque factor will be very help for the further Design (or purchase) details.
5. Will the equipment be in a radiation area, if it is, which level?
6. Electrical power, 240v or 120V? Three phase AC motor is ok? Or what's your choice?

Please feel free let me know if you have any questions regarding the above, also, it will be great appreciate to have the budget code for this.

Edward
X2879

-----Original Message-----
From: Dave Pushka [mailto:pushka@fnal.gov]
Sent: Monday, August 02, 2010 2:52 PM
To: Edward C. Chi
Subject: Fw: FW: Test Beam Turntable

Ed,

Here is a job request tht came in a few months ago for a rotary table for general use in M-Test.

Would you see what commercial equipment is available and make a recommendation to Aria.

Thanks,
Dave

----- Original Message -----
From: "Aria Meyhoefer" <aria@fnal.gov>
To: "Dave Pushka" <pushka@fnal.gov>
Cc: <rls@fnal.gov>
Sent: Monday, June 14, 2010 11:21 AM
Subject: Re: FW: Test Beam Turntable

> Hi Dave,
> I think we're looking for a table for general use, not for a particular
> object.
>
> ~Aria
>
> Fermi National Accelerator Lab
> Test Beam Facility Manager
> MINOS Underground Areas Coordinator
> Office: 630.840.4463
> home.fnal.gov/~aria
>
> Please consider the environment before printing this email
>
> ----- Original Message -----
> From: Dave Pushka <pushka@fnal.gov>
> Date: Monday, June 14, 2010 9:59 am
> Subject: Re: FW: Test Beam Turntable
> To: Aria Meyhoefer <aria@fnal.gov>
> Cc: rls@fnal.gov
>
>
>> Any additional information about the object supported by this table
>> would be
>> useful. For instance, where is the c.g. w.r.t. the center of rotation?
>>
>> - Dave
>> ----- Original Message -----
>> From: "Aria Meyhoefer" <aria@fnal.gov>
>> To: "Dave Pushka" <pushka@fnal.gov>
>> Cc: <rls@fnal.gov>
>> Sent: Wednesday, June 09, 2010 2:33 PM
>> Subject: Re: FW: Test Beam Turntable
>>
>>
>> > Hi Dave,
>> > Sorry this took so long! We're looking for a platform which can
>> support
>> > about 2000 lbs, and could rotate it remotely with 1 degree accuracy.
>> the
>> > platform could be very roughly about 1meter in diameter. (It doesn't
>>
>> > necessarily have to be round)
>> > Those are all the requirements I can think of right now. If you
>> could
>> > ballpark an estimate I could locate a task code.
>> >
>> > thanks,

>> >
>> > ~Aria
>> >
>> > Fermi National Accelerator Lab
>> > Test Beam Facility Manager
>> > MINOS Underground Areas Coordinator
>> > Office: 630.840.4463
>> > home.fnal.gov/~aria
>> >
>> > Please consider the environment before printing this email
>> >
>> > ----- Original Message -----
>> > From: Adam Para <para@fnal.gov>
>> > Date: Thursday, May 27, 2010 10:56 am
>> > Subject: FW: Test Beam Turntable
>> > To: 'Aria Meyhoefer' <aria@fnal.gov>
>> >
>> >
>> >> Aria,
>> >>
>> >>
>> >>
>> >> Can you provide Dave with the info?
>> >>
>> >>
>> >>
>> >> Adam
>> >>
>> >>
>> >>
>> >> From: Richard Schmitt [mailto:rls@fnal.gov]
>> >> Sent: Thursday, May 27, 2010 10:53 AM
>> >> To: Adam Para
>> >> Cc: Dave Pushka
>> >> Subject: Test Beam Turntable
>> >>
>> >>
>> >>
>> >> Adam,
>> >>
>> >>
>> >>
>> >> We can help with the test beam turntable that you discussed with
Terry
>> >> Tope.
>> >> Please provide Dave Pushka with the requirements, dimensions and
task
>> >> code.
>> >>
>> >>
>> >>
>> >> Richard Schmitt
>> >>
>> >> Fermilab
>> >>
>> >> 630-840-4849